# U.S. National Ice Center

USN

USCG

NOAA

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**Naval Ice Center Executive Officer**

# U.S. National Ice Center

## Mission

The U.S. National Ice Center (NIC) is a tri-agency partnership of the United States Navy (USN), the National Oceanic and Atmospheric Administration (NOAA), and the United States Coast Guard (USCG) providing global ice and snow analysis and short term forecasting services for the maximum benefit of the United States government.

## Vision

Provide global ice and snow analysis and short term forecasting services for the maximum benefit of the United States government.

## Goals

Goal 1. Develop Capabilities

Goal 2. Transition Science and Technology

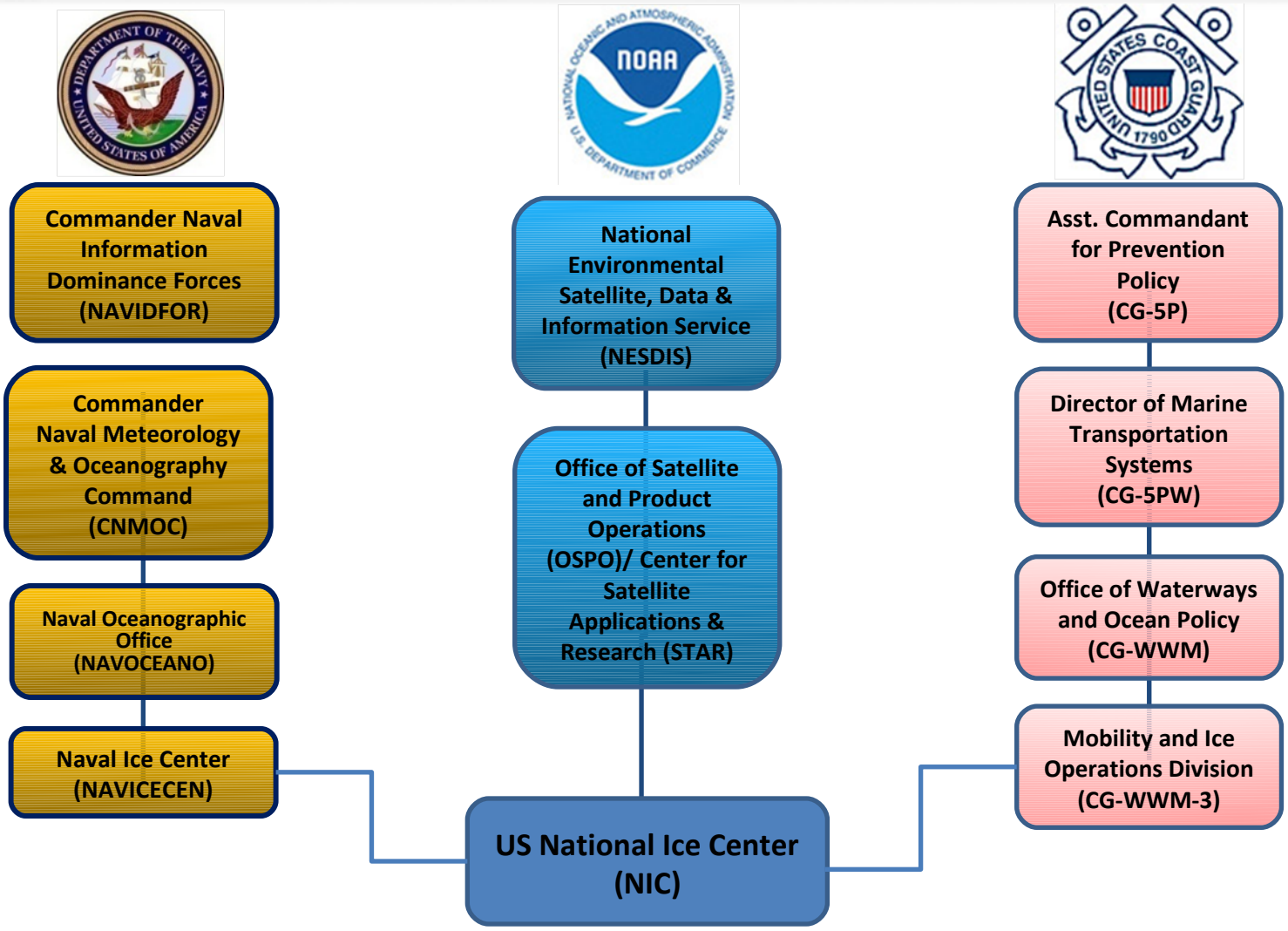

Goal 3. Strengthen Partnerships

Goal 4. Professional Excellence

# U.S. National Ice Center History

- **1976: Common requirements between Navy and NOAA resulted in the formation of the Navy/NOAA Joint Ice Center (JIC).**
- **1995: USCG joined, JIC became the U.S. National/Naval Ice Center (NIC/NAVICE).**
- **NIC responsibilities established via Annex V under the MOA between DOC and DON.**
  - Participating authorities
    - NOAA: 15 U.S.C. § 313, 15 U.S.C. § 2921 et seq., and 15 U.S.C. § 1525.
    - Navy: 10 U.S.C. § 5013.
    - USCG: 14 U.S.C. § 141.
- **Annual Management and Operations Plan for the NIC is approved by the Executive Steering Committee.**

# USNIC Organization




Total manpower: 37 personnel; 65% Navy, 33% NOAA, 2% USGC

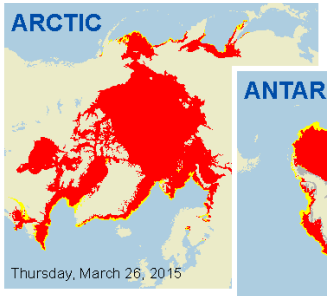
# USNIC Directives

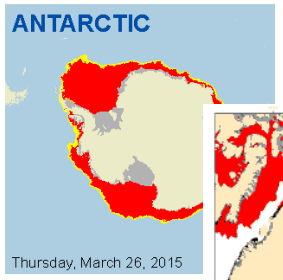

- **Requirements, Agreements, and Understandings**
  - USN: 10 U.S.C. 5013
  - SUBFOR Requirements Letter 3470 04 Sep 2013
  - USCG: 14 U.S.C. 141; USCG Requirements Letter 26 Jun 2009
  - MOA between DoD/DoN and DoC/NOAA 20 Dec 2013
  - LOA between NWS and NIC 11 Mar 2011
  - NOAA: 15 U.S.C. 313 NWS Organic Act, 2921, 1525
  - EC-NOAA MOU, NAIS Annex 2008
  - Commerce and Transportation, Marine Weather (CT-MWX)
  - Environmental Modeling EMC & MWX PORD Documents
  - DOC Organization Order 25-5 Section 10.02 & Section 10.03

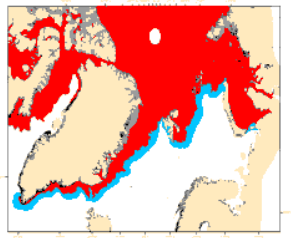
# USN Requirements

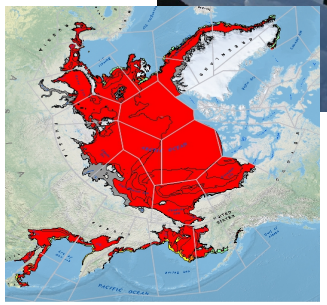
**SUBFOR Requirements**
Daily Ice Edge w/3NM
Daily MIZ w/3NM
48HR Ice Edge Forecast w/3NM
Sea Ice Routing/FLAP - as required (up to 2X daily)
w/I 4NM
Estimated ice thickness bi-weekly or as required w/I 10cm
Iceberg location w/3NM (Arctic/Antarctica)
Climatological outlooks as required

**FWC Requirements**
Ice edge information (route specific) Resolution 0.5 km,1 route/ship, every other day or as required
Ice edge information (generic) Resolution 25 km, daily
Ice coverage (analysis and 24 hour forecast) Resolution 0.5 km daily, and as required in ports/waterways
Ice thickness information. Resolution 0.5 m ,as required for tactical ops.





# NOAA Requirements

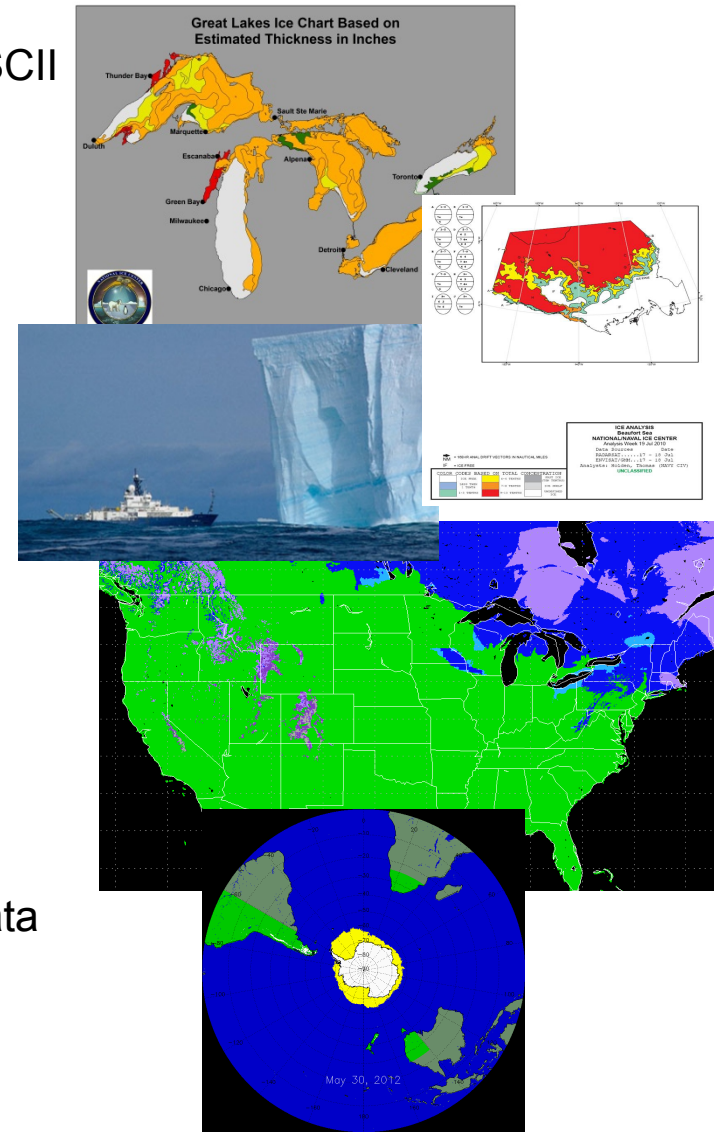
**Great Lakes Ice Monitoring (Dec-May)**
Daily Ice Conc/Thickness. Resolution 5 km ,GRIB and ASCII
Weekly Ice Thickness & Form
1-7 day forecast
NAVTEXT message (Dec-Mar)

**CONUS Ice Monitoring (Dec-May)**
Weekly or Bi Weekly - Chesapeake and Delaware Bays

**Alaska Ice Monitoring**
Twice weekly Ice Charting in PDF and Shapefile
SAR Imagery support for NWS Alaska Ice Monitoring
Ice edge and GRIB format

**Global Snow and Ice Monitoring**
2x Daily Gridded Ice/Snow Extent for North America, 1km
Global Daily Snow Depth, 4km
Northern Hemisphere Daily Ice Concentration, 4km
Northern Hemisphere Daily Ice Thickness, 4km
Days since last observation for Snow and Ice Analysis Data

**Special Support of NOAA Vessels**



# USCG Requirements

**Arctic / Antarctic**

**Daily Sea Ice Edge** – Daily during operations, 2x month off season.
Arctic – w/i 50m of edge; Antarctic w/i 2nm

**Daily Sea Ice Concentration** – Daily during operations, 2x month off season.
Arctic – w/i 50m and 2/10ths coverage; Antarctic w/i 10nm and 2/10ths coverage

**FLAP** - As requested - daily during operations, 2x month off season.
Features >200m in length

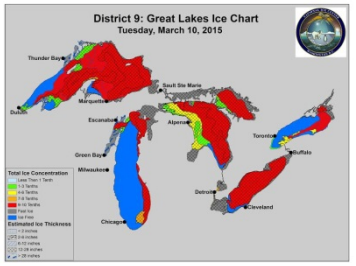
**Daily Estimated Sea Ice Thickness** - Daily during operations, 2x month off season w/i 10cm of actual

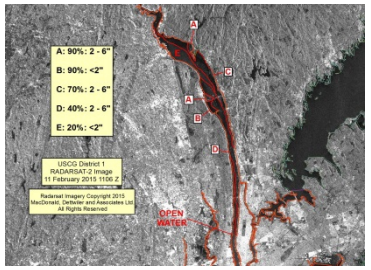
**Daily Iceberg Location** – Daily during operations, 2x month off season. w/i 2 km of actual; Imagery w/I 3 hrs of receipt

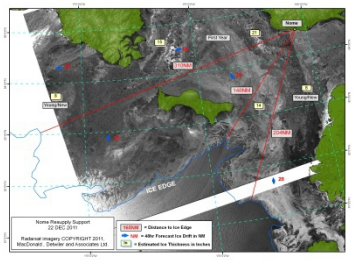
**Daily Imagery Analysis/Forecast** – As requested for operations/environmental awareness w/i 100nm radius of vessel

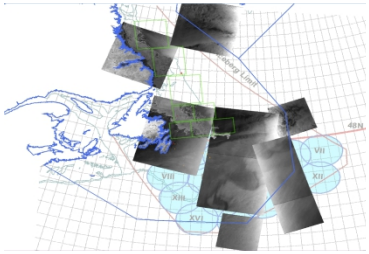
**Climatological Outlooks -** as requested
Arctic w/I 25nm; Antarctic w/I 20nm

**Icebreakers or Aerial Recon**
Embarked ice analysts or Aerial Recon for real time ice observations and analysis as requested
Annotated imagery analysis/forecasts

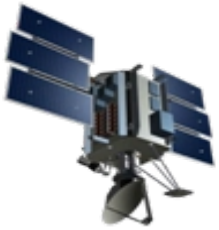


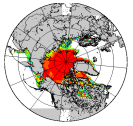
# Product Generation



Satellites

+

Buoys



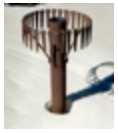
Models

Aircraft

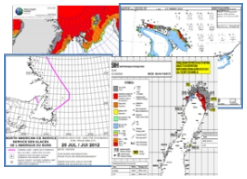
Webcam

Radar

Ship Obs



Surface Obs



International Partners

**Other Sources**

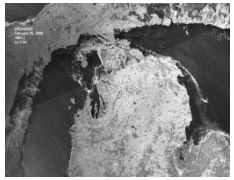
**Geographic Information System**

**Meteorology**

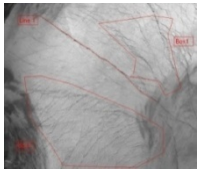
**Automation**

**Subject Matter Expertise**

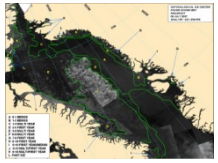
**Interpretive Snow and Ice Analysis and Ice Forecasting**



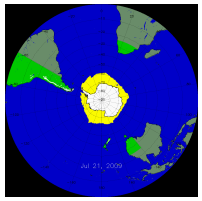
SAR Imagery



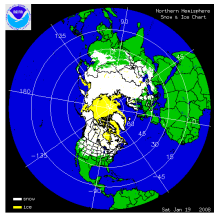
Fractures, Leads and Polynyas (FLAP)



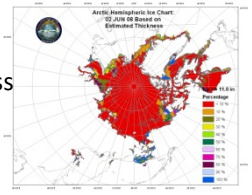
Annotated Images



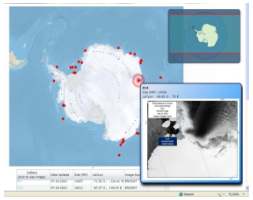
Automated Snow and Ice products



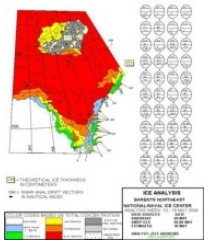
Blended Snow and ice cover



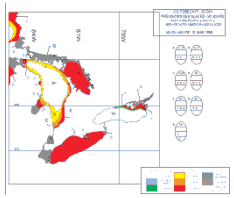
Ice Thickness Estimations



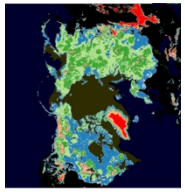
Antarctic Icebergs



Hemispheric and Regional Ice Charts

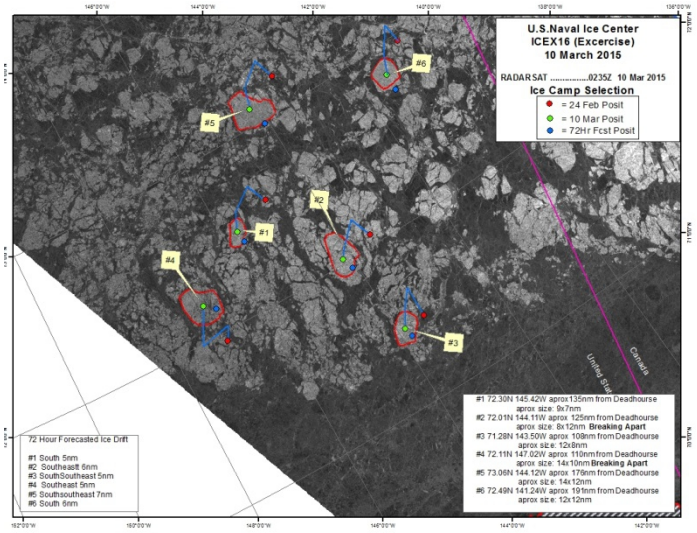


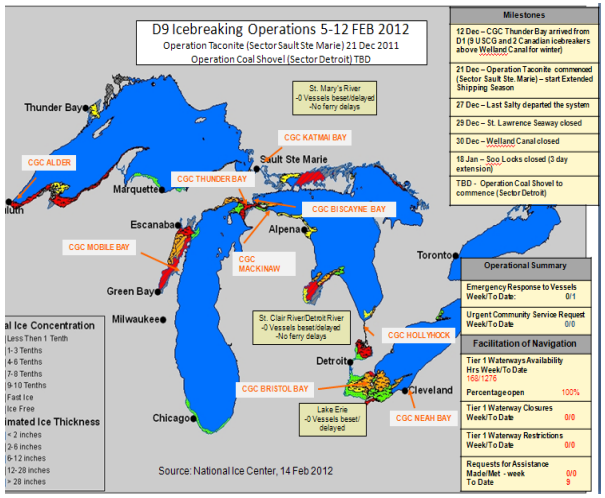
Ice Forecast Outlooks

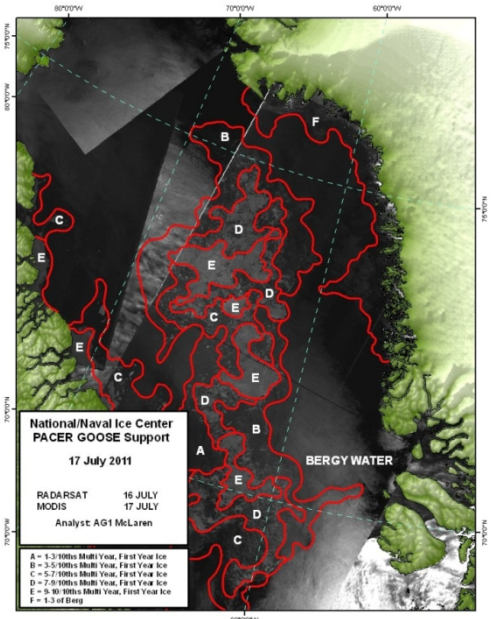


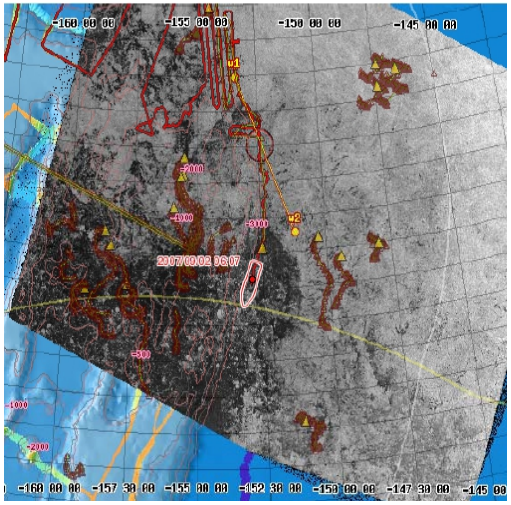
Blended Snow Depth

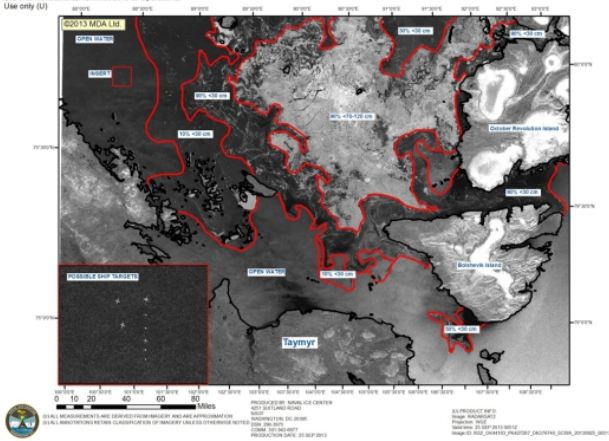
# USNIC Tactical Support

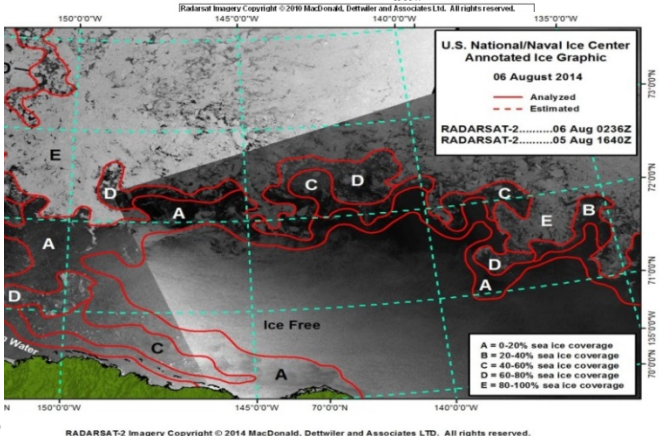


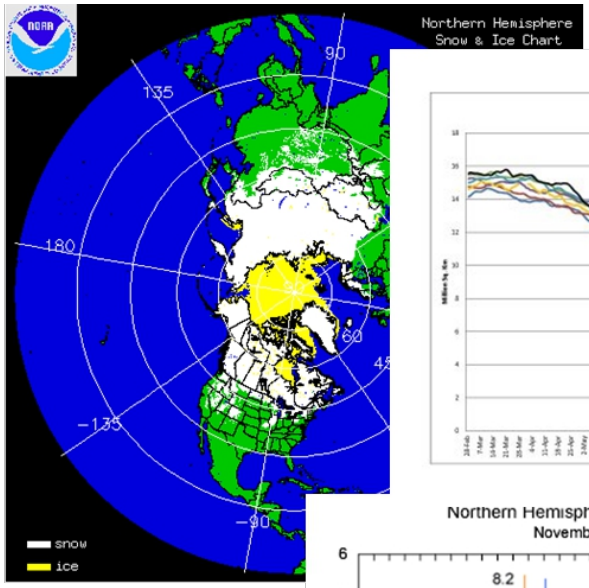
# USNIC IMS Blended Snow and Ice

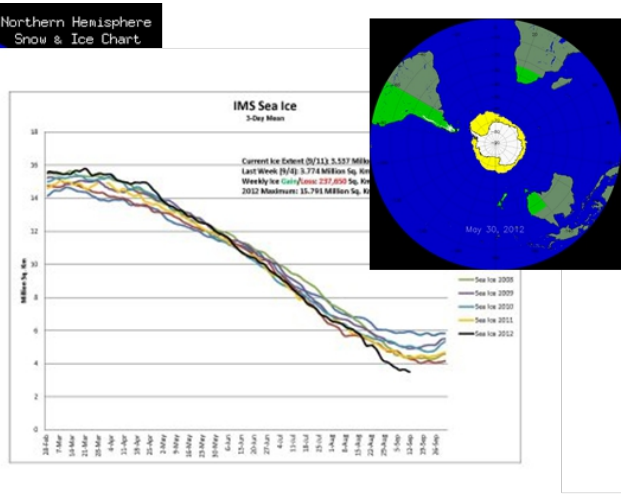
## Primary Customers

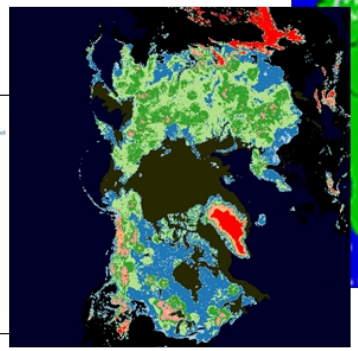
NOAA NWS NCEP Environmental Modeling Center (EMC)
Climate Prediction Center (CPC)

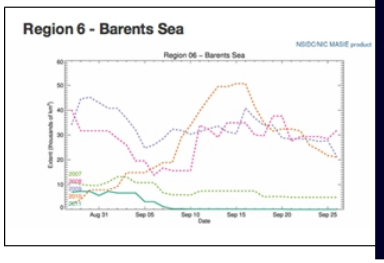
## Known Secondary Customers

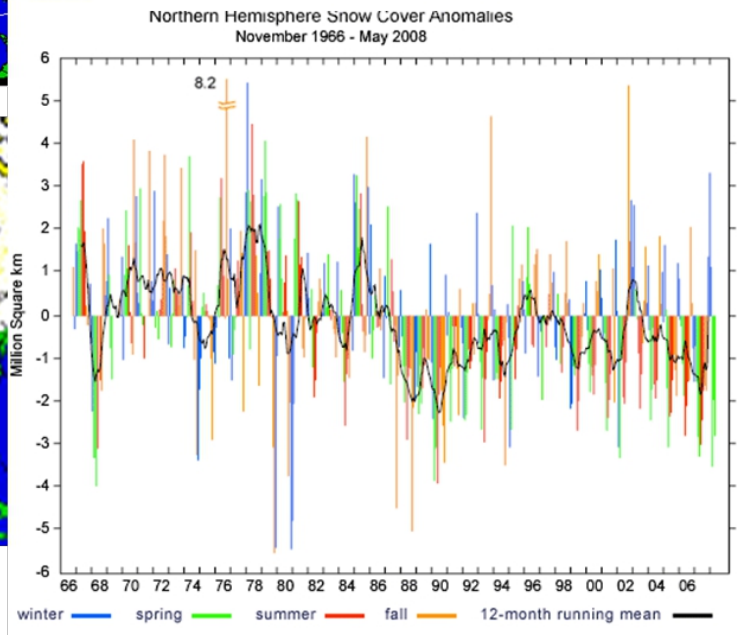
US Army, US Air Force, USDA, NOAA SSD, US DoT, Environment Canada, EMCWF, UK Met, FNMOC, NAVO Numerous Universities, Weather Channel, CNN, AccuWeather, private companies, and general public





# Domestic Partnerships *(Abridged)*

- National Snow and Ice Data Center
  - Works on behalf of NESDIS NCEI to archive NIC data and co-generates the Multisensor Analyzed Sea Ice Extent (MASIE) with NIC.
- NASA – Goddard & Jet Propulsion Lab.
  - Algorithm testing and development. Early Adopter for NASA SMAP mission.
- Naval Research Labs
  - Help evaluate the utility of new USN models and partners on projects to improve model .
- Rutgers University Global Snow Lab
  - Climate Data Record (CDR) from NIC Blended Snow
- Office of Naval Research
  - Development of .
- University of Washington - APL
  - Polar research partners

# International Partnerships

- North American Ice Service (NAIS)
  - Multi-agency partnership between U.S. National Ice Center (NIC), Canadian Ice Service (CIS), and International Ice Patrol (IIP).

- International Arctic Buoy Program (IABP)
  - Global participants working together to maintain a network of drifting buoys in the Arctic Ocean.

- International Ice Charting Working Group (IICWG)
  - Promotes cooperation between the world's ice centers on all matters concerning sea ice and icebergs.

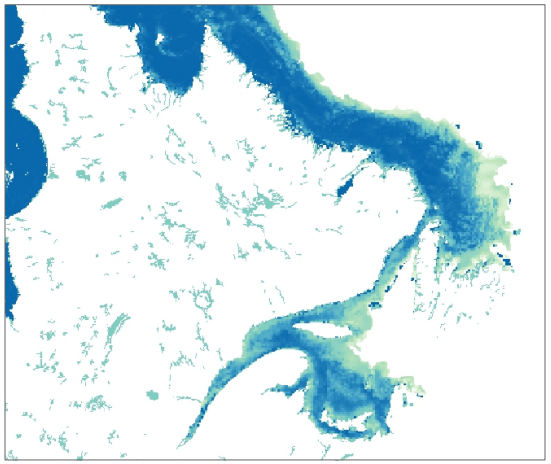
- WMO Expert Team on Sea Ice (ETSI)
  - Formal coordination of sea ice activities on the level of WMO/IOC that provides technical direction to the WMO Secretariat.

- WMO Global Cryosphere Watch – SnowWatch
  - Promotes cooperation between the world's snow observing nations. Working on improving snow monitoring.

# NIC & NOAA Arctic Action Plan (2012)

## Improve ice, weather and water forecasts and warnings

- Improve snow depth, snow cover, ice cover, and ice thickness analysis for operational model initialization or assimilation
- Integrate new satellite-derived sea ice information into National Ice Center operations, such as ice thickness, ice concentration, and size of leads (fractures) in ice



## Strengthen foundational science to understand and detect Arctic climate and ecosystem changes

- Conduct coordinated calibration and validation of satellite measurements of the cryosphere through in-situ and airborne missions in collaboration with national and international partners

## Enhance international and national partnerships

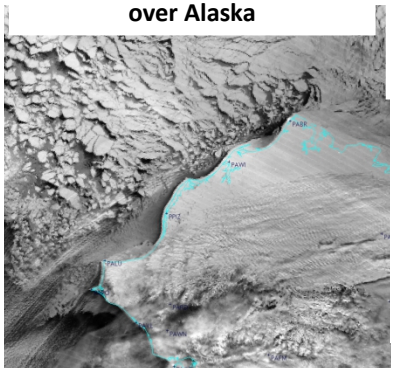
- IICWG, NAIS, NASA, UofWashington, WMO Cryosphere Watch
- Coordinating with national and international partners to broaden geographic coverage of Arctic sea ice analysis and forecasting

# JPSS & GOES R

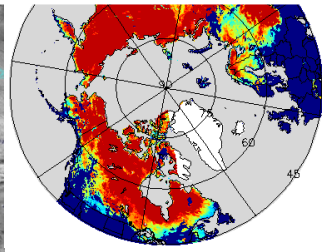
**NIC Currently applies imagery and a few derived data from NASA/NOAA Suomi NPP**

- High Resolution Visible Channels
- High Resolution Infrared Channels
- Visible imagery at night, Needed for the Polar Winters
- Sea Ice Concentrations
- Snow cover detection
- Snow Depth and Sea Ice Concentrations from Microwaves

SNPP Visible imagery at night over Alaska



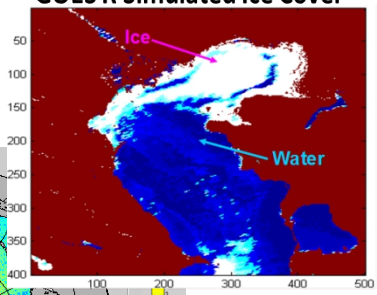
Snow water equivalent (SWE) using microwave data. Hot colors = More SWE

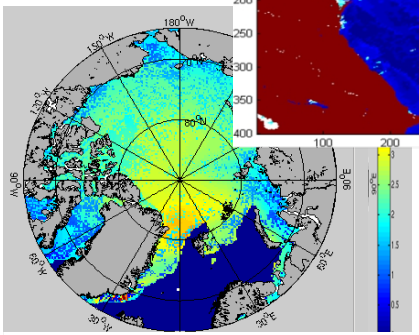


**JPSS & GOES R Next Generation NASA/NOAA Satellites should further enhance the ability to detect ice and snow**

- JPSS will offer a follow-on to S-NPP
- JPSS algorithms will be more applicable to NOAA and NIC needs
- GOES R will offer much better capacities offered by the current geostationary satellites
- Partnerships with ESA, JAXA, and CSA are vital to ensure global coverage
- <u>Seeking to apply JPSS and GOES R products that can more directly improve analyses</u>

GOES R Simulated Ice Cover



JPSS Simulated Ice Thickness

# SAR Imagery Requirement

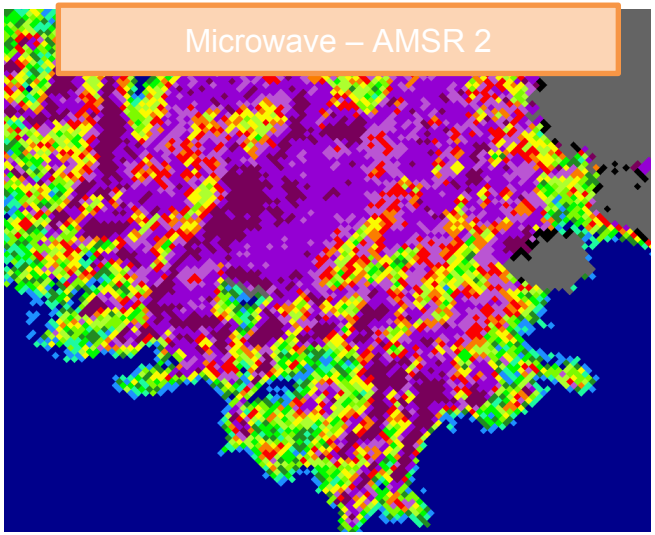
Synthetic Aperture Radar imagery is the primary data for Arctic sea ice analysis and forecasting in support of US Submarine Forces and other ice monitoring.

- Only 30% of NIC's SAR imagery requirement in the Arctic Basin is currently met.

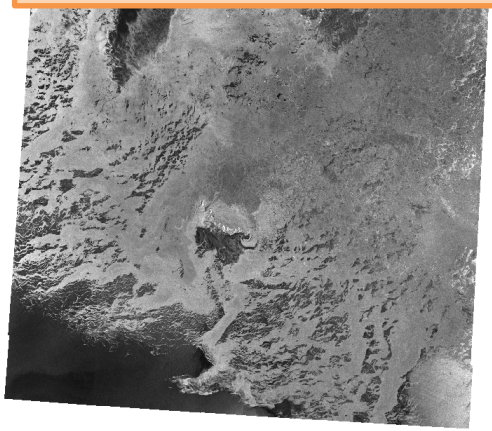
- Other visible, infrared, and lower resolution data sources are applied to provide help estimate ice cover and characteristics.

Visible Imagery – VIIRS (SNPP)

Microwave – AMSR 2



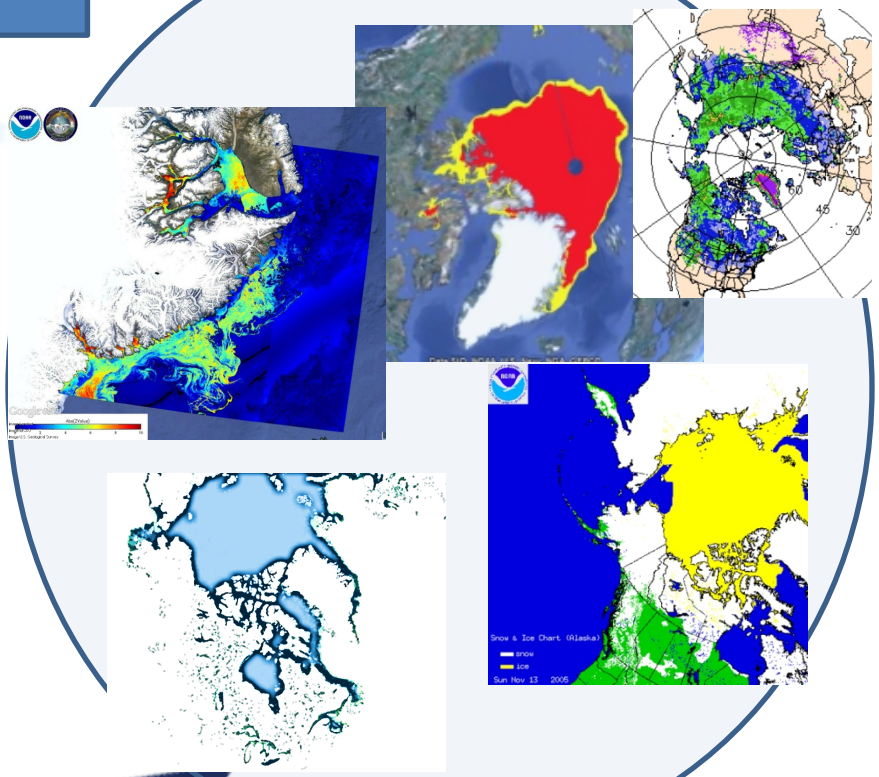
SAR Imagery – CSA RadarSat 2



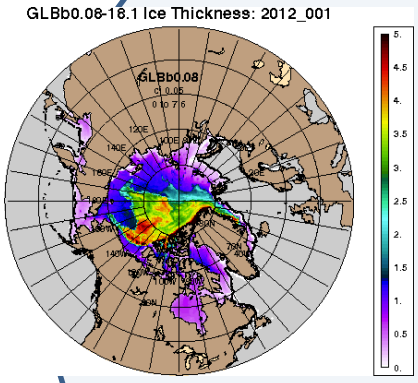
# Integration with Models

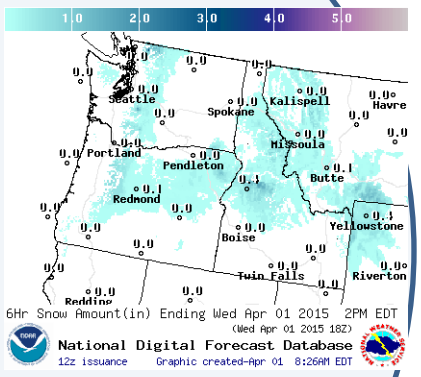
**CUSTOMERS & PUBLIC**

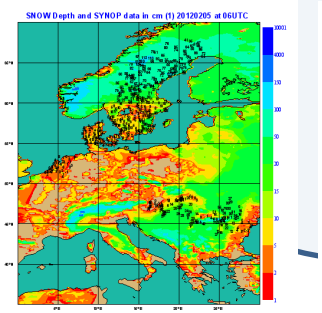
**NIC Analysis**

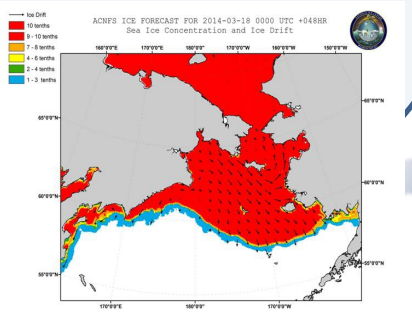


**Navy and NOAA Models (and others)**




Models provide forecasts for NIC forecasters which apply NIC analysis data.

# Discussion